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TRIP REPORT

Support for a quality approach for Malian Agricultural Export Products

May 9 through June 19, 1999

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Central Veterinary Laboratory
Toxicology Unit

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SUMMARY

This study had a twofold objectives :

To define a strategy and various steps for its implementation in order to improve the quality of Malian agricultural products and guarantee their compliance with regulatory requirements of importing countries, particularly European Union member States.

To define the future role of the toxicology unit of the Central Veterinary Laboratory and to identify a capacity building strategy for this laboratory to help it meet international requirements inherent to laboratories designed for phytopharmaceutical residue analysis.

The strategy identified to improve the quality of Malian agricultural exports requires for each product sector the definition and enforcement of quality insurance systems, from the production of agricultural raw materials to the final products, including transformation and packaging. These quality insurance systems should integrate the principles of the HACCP approach, which is recognized as the most reliable method in food security.

Successful implementation of this approach will depend on the will of entrepreneurs and their motivation for the quality approach.

In order to improve the reputation of Malian export products, it is also recommended that Malian authorities implement a national policy of food product security control and to define a national laboratory policy.

It is noted that the toxicology unit of the central veterinary laboratory may be involved in the implementation of the national policy for food product quality control, or become a sub-regional reference laboratory for pesticide residue analysis.

To achieve this, the toxicology unit needs to be reinforced in terms of infrastructure, equipment, working methodologies, management and human resources, in order to gain an internationally recognized quality certification, which will, in the medium term, be essential for such laboratories.

Introduction

Origin of the mission

This study is part of the activities of the Center Agro-Enterprise (CAE) whose main objective is to develop economic activities within the agro-industrial sector in Mali. CAE's activities are particularly geared towards Malian agricultural and agro-food sector enterprises.

One of the most specific objectives of the project is to participate in capacity building within Malian institutions interested in agro-industry. The Central Veterinary Laboratory (CVL) of the Ministry of Rural Development and Water is an institution involved in the provision of services to the agro-industrial sector. Building capacities within the CVL, toxicology unit, was initially identified as a means for improving the quality of Malian agro-industrial products.

Objectives and expected results

The objective of the study is to identify a strategy and various steps needed to implement it in order to create a quality label for Malian export products, which would be recognized in importing countries, particularly in the European Union member countries.

A more specific objective is to change the focus and operational procedures of the Central Veterinary Laboratory (CVL) to improve services the toxicology unit eventually provides to entrepreneurs.

III. THE ACTORS

The mission was carried-out by two consultants:

- a specialist in international and European regulations affecting plants and vegetable exchanges. His task consisted in identifying a strategy for improving the quality of Malian agricultural export products;

- a specialist in analytical chemistry, phytopharmaceutical product residue analysis. His mission was to perform an audit of the toxicology unit of the Central Veterinary Laboratory and to identify improvements to be achieved so that analyses performed be internationally recognized.

CHAPTER 1

MAIN CONCLUSIONS OF THE MISSION

I. The quality approach

I.1. Quality control for food products in Mali

There is no appropriate law in Mali regarding health security control for food products, nor any efficient quality control institutions. This gap is a threat, on the one hand for the health of Malian consumers and, on the other hand, for export products, particularly towards the European Union, due to the risk of borders being closed for Malian products in case a serious hygiene problem arises.

The need for capacity building for regulation and quality control in food product hygiene was even mentioned in the guideline for rural development in March 1992.

The lack of phytosanitary regulation may also be another reason for denying access to certain markets for Malian products.

I.2. Limits of the "Mali quality label" under preparation

Establishment of the "Mali quality label", which is under preparation, depends on the creation of a traditional quality control system such as described in Chapter 3, paragraph IV.2.1 and based on a compulsory administrative control at the exit.

Such a system, on the one hand, does not correspond to the most reliable system in food product security matters and consequently may lack credibility in international markets and, on the other hand, will impose additional bureaucratic constraints on exports, extending stand-by time at exit points (the Bamako airport particularly), which in turn may affect the quality of products.

This system is one of the most inadequate for the development of exports, considering the costs and period of time inherent to laboratory analyses, which will eventually be required by legislators. In addition, it should be noted that this à posteriori control system does not allow for neither correcting nor eliminating the non-quality factors.

Moreover, establishment of a compulsory "Mali" label may create rigid constraints for exporters, preventing them from adapting their products to the evolution of traditional markets or the requirements of new markets.

It would be better to substitute a modern and recognized approach which is more efficient, i.e., quality insurance.

I.3. Proposed strategy for improvement of the quality of Malian export products

1. To establish a Code of practice which would be accepted by a certain number of pilot exporters interested in the quality approach. Then, training of professionals and the staff of concerned administrative departments (particularly the hygiene service of the Ministry of Health, which is responsible for controlling agro-food enterprises) in the application of the quality approach (particularly the HACCP system).

NB: *The Code of practice defined by pilot entrepreneurs involved in the quality approach, should be confidential if it is aimed at promoting a trademark or at leading to an enterprise certification.*

2. To establish infrastructure needed to set-up the code of practices:
   - packaging stations and/or transformation plants that respect minimum hygiene rules,
   - access to cold storage rooms in good conditions and reserved exclusively for storage of fruit and vegetable[1].

3. To define technical agricultural itineraries for each product (mangoes, French beans), particularly for phytosanitary treatment, target pests, chemicals for treatment (active matters, commercial products, doses, treatment periods); phytosanitary treatment should be submitted to validation for the enforcement of MRL in importing countries[1].

   Validated products should then be submitted to authorization for sale in the sub-regional market issued by the Sahelian Pesticide Commission.

4. To implement codes of practice among pilot exporters (or groups of exporters) and implementation of a quality insurance system among these entrepreneurs (creation of an internal auditing organization is highly recommended).

5. Establishment of a trademark deposited in Mali, which may be used only by members of the collective organization and compliant with the code of good practice.

6. Allowing access to the trademark for entrepreneurs committed to enforcing the schedule of conditions - at this level, an internal auditing system becomes essential.

7. Two options may then be envisioned:

7.1. Transformation of the trademark into a quality standard for all Malian producers willing to participate. Creation (identification) of a certifying institution.

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[1]. Once the technical itinerary is validated, residue analyses are no longer necessary, except casually to verify that there is no breach of the quality control system.

7.2. Certification of the Group (and of entrepreneurs) for an international quality insurance system (such as ISO 9002, for example).

8. Advertising activity in order to make the "quality standard" or trademark better known, along with its new "certified" status.

II. The Toxicology Unit of the Central Veterinary Laboratory (CVL)

II.1. Capacity of the Toxicology Unit of CVL

The toxicology unit has some modern equipment entitling it to envisage to become a national or sub-regional reference laboratory for the analysis of phytopharmaceutical product residues or other toxic products.

However, the premises made available to the toxicology unit are not compliant with international standards in force (BPL[2] or equivalent[3]). In addition, there is a lack of essential equipment to obtain quality accreditation.

However, the toxicology unit is not presently operational because the staff does not familiar with the use of available equipment.

II.2. Role of the CVL's toxicology unit in the quality control for food products

II.2.1. Role of the national pesticide residue laboratory

A phytopharmaceutical product residues analysis laboratory may intervene in various areas:

1. quality control for food products being sold; this activity falls under national programs for surveillance of pesticide residues; this activity is normally financed through the national budget.
2. pesticide residue research in the environment (water, soil, sediments, etc.), as part of a national policy for assessing and monitoring the environmental impact of phytopharmaceutical products; this activity should be financed through the national budget;
3. study on the approval of phytopharmaceutical products; in principle this activity is financed by the users. It should be noted that in Mali, pesticide approval process is the same as in all CILSS member countries, and eventually, only a limited number of laboratories in the sub-region will be qualified enough to perform toxicology studies in relation to the approval of phytopharmaceutical products.
4. service delivery to research centers, private enterprises and any entities, whether national or not, wishing to perform residue analysis; the costs for these service delivery activities should

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[2]. BPL = "Bonnes Pratiques de Laboratoire" (laboratory best practice).

[3]. See *Codex* guidelines regarding good practice in pesticide residue analyses.

be supported by the clients on the basis of invoices.

II.2.2. Role of the CVL's toxicology unit

Mali has two laboratories which may be involved in the control of phytopharmaceutical product residues: the CVL and the National Health Laboratory (NHL).

Presently, the CVL has more modern and performing equipment than the NHL, in terms of phytomarceutical products residue research. In fact, the NHL is equipped to perform analyses through chromatography on thin layers and in gaze phase, but utilizes only chromatography on thin layers.

Therefore, the CVL's toxicology unit, to-date, is the Malian institution which is best equipped to become the national reference laboratory for pesticide residue analysis.

However, the toxicology unit will be in competition with other laboratories in the sub-region (the Locustox laboratory in Dakar, the Burkina Faso laboratory, etc.) particularly for toxicological testing contracts for approval, and thus become the regional reference laboratory.

To win contracts 3 and 4 mentioned above, it is essential that the toxicology unit of CVL reach a very high level of skills and particularly obtain in the medium term a quality accreditation that is internationally recognized.

In view of sustainable development of the toxicology unit's activities, it is therefore essential to set as an objective, the acquisition of a quality accreditation (BPL or equivalent) and to implement at the national level and possibly the regional level, policies for the monitoring and evaluating the impact of phytopharmaceutical product residues on public health and environment.

CHAPTER 2

Recommendations

1. Recommendations for quality improvement of agricultural export products

The improvement of the quality of fruit and vegetable intended for exportation, requires enforcement of quality insurance systems based on self-control, creation of total field traceability for consumers and enforcement of the schedule of conditions by the entrepreneur, as well as establishment of a guide for sanitary good practice for each product.

These guides may constitute the basis for creation of quality insurance systems which may, eventually, lead to quality certification, if accepted and implemented by a majority of Malian exporters (ideally, the whole members of AMELEF, in the case of fruit and vegetable).

For each product sector these guides should cover the following:

1. Good agricultural practice for the production of raw materials;
2. characteristics of the packaging stations and of transformation plants;
3. hygiene rules for the maintenance of machinery and facilities;
4. hygiene rules for staff handling food products
5. a risk analysis for packaging, treatment and transformation activities, if the case arises;
6. hygiene rule regarding transportation.

A draft guide of sanitary practice for horticultural products in Mali is proposed in Annex I to this report. It is obviously necessary to establish a specific schedule of conditions for each product sector.

To ensure successful implementation of the approach, it is also essential that professionals be very strongly involved in the definition of sanitary practice guides.

II. Recommendations for Malian Authorities

In order to reinforce control of food products in Mali and thus be trusted by potential importers as regards health security of Malian products, it is recommended that Malian authorities take the following actions:

II.1. To create appropriate legal and regulatory tools

II.1.1. *To vote a modern law about food products produced or sold in Mali including:*

- a general horizontal law, based on the WFO model; accountability of entrepreneurs is an essential element; introduction of the principle of the HACCP approach should be made compulsory.
- Specific application regulations about the following aspects: labeling, food standards, specific hygiene rules, additives, pesticide residues and other toxic products such as heavy metals, mycotoxine, veterinary product residues, criteria for water safety, etc[2].
- Voluntary standards (code of conduct, hygienic good practice, labels, etc.) which will be enforced by entrepreneurs on a voluntary basis, according to the requirements of their respective markets.

II.1.2. *To vote a law on the control of fertilizing materials including an enforcement law and regulation.*

II.1.3. *To promulgate an enforcement regulation for phytosanitary control including:*

- the list of quarantine pests in Mali;
- the list of phytosanitary requirements for plants and vegetable imports;
- the list of plants, vegetable and other object which are banned for importation, if the case arises

II.1.4. *To deregulate exports and phase out the State from export product quality control activities, in conformity with the guideline of rural sector development (March 1992) which states:*

> *"As for agricultural and livestock products intended for exportation, experience in numerous countries has proved that it is useless, and often with a paralyzing bureaucracy, to entrust the public sector in the exporting country with the function of quality regulation and control. These functions should be assumed through an agreement between exporters and their clients..."*[4]

II.2. To build capacity among administrative institutions needed to enforce the regulation.

II.2.1. *The public hygiene service of the Ministry of Health for quality control of food products (hygiene, contaminating agents, etc.).*

The hygiene service staff, responsible for the control and approval of agro-food enterprises, should be trained in the principles of the HACCP approach at the same time as entrepreneurs.

II.2.2. *General and Regional Directions of Regulation and Control (controlling agricultural products at production, phytosanitary control, controlling phytopharmaceutical and fertilizer application and marketing).*

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6. Guideline for rural sector development - Ministry of Agriculture, Livestock and Environment - *Volume 2 Development Strategies* - March 1992m p.54.

II.2.3. *National bacteriology laboratory (to be identified, Central Veterinary Laboratory or National Health Laboratory).*

II.2.4. *National laboratory for the control of chemical contaminating matters (to be defined, Central Veterinary Laboratory, National Health Laboratory, CILSS sub-regional laboratory or an international laboratory).*

Regarding laboratory issues, identified facilities should imperatively obtain an "appropriate quality" certification (BPL or equivalent), to become a "national reference laboratory", so that the results of their tests be internationally recognized.

Since there may not be enough market for several toxic product analysis laboratories in Mali, it is essential that Malian authorities define a national laboratory policy:

- a national laboratory, in this case which one; or
- a sub-regional laboratory, in this case, the responsibilities of CVL and NHL should be revised; or
- an international laboratory (for example, SGS company) to which responsibility for pesticide residue monitoring in Mali may be delegated.

II.3. Funding for control institution operations

Laboratory and compulsory control institution activities must be financed from the national budget. In order to ensure that various institutions will receive appropriate budgets, the following measures are proposed:

- Establishment of user fees for phytopharmaceutical products sold in the Malian market (project under study at the sub-regional level with CILSS-FAO Program to support the Sahelian Pesticide Commission) to feed a contribution fund partially designed to finance the reference laboratory for pesticide residue monitoring activities on and within products sold in the Malian market, and partially for the operation of DGRC which is responsible for pesticide utilization;

- Establishment of phytosanitary dues (for phytosanitary control at both import and export), to feed a contribution fund designed for the DGRC phytosanitary control activities.

II.4. Reinforcing the role of official institutions to help open markets for Malian products

Malian authorities should also seek high level expert services in all aspects of regulation that affect international trade, particularly health and phytosanitary legal dispositions, in order to be able to negotiate market outlets with third party countries.

To this effect, it is essential that Mali participate in international fora such as the *Codex Alimentarius*, the International Convention for Plant Protection or the World Trade Organization's Sanitary and Phytosanitary Commission.

III. PROPOSED ACTION FOLLOWING THE MISSION

III.1. To provide support to motivated entrepreneurs to help define codes of sanitary practice based on the draft project proposed in Annex I and on the community regulatory requirements.

III.2. Implementation of the codes of hygienic practice.

III.2.1. *At the agricultural production level*

- To define technical agricultural itineraries for two main export products (mangoes and French beans), particularly including the following:
  - a list of phytopharmaceutical and other products authorized (by the Code of conduct) for the two crops,
  - the authorized dose for each product, the treatment period, the length of treatment time before harvesting, if the case arises.
  - the implementation of a crop book that guarantees the enforcement of technical itineraries recommended by the Code.

- To validate technical itineraries contained in the Code vis-à-vis target importing countries' MRL (to conduct a residue research through an accredited laboratory in an importing country).

- To provide training to producers on the recording of agricultural activities (keeping a crop book).

- To provide training to producers/users of phytopharmaceutical products in the use of these products[5] as well as in spray maintenance.

- To train producers in the management of phytopharmaceutical products (stock and waste management).

- To support the establishment of agronomic services shared by several entrepreneurs in order to monitor respect of the schedule of conditions at production and to provide assistance to producers.

5. Training should be related to the type of spray spraying used.

III.2.2. *At the exporter level*

- To create necessary environment for the management of minimal infrastructure to enforce the Code of conduct (GIE, cooperative, limited company whose shareholders will be exporters, etc.).

- To create ad-hoc infrastructure (packaging station, cold room, etc.).

- Setting-up a quality insurance system that guarantee full traceability of products and operations, on the basis of the quality insurance Handbook for export horticultural products, by the Natural Resources Institute.

- To provide training to motivated professionals for implementation of the quality approach.

III.3. Identification of technical itineraries for the two main export products

III.3.1. *French bean crops: designing an integrated caterpillar control method (Helicoverpa armigera species)*

Problem statement: *H. armigera* is a quarantine pest within the European Union. Therefore, French beans must be totally free of this pest.

Proposed solution: to design efficiency tests during the next "French bean" campaign, while respecting the recommended pre-harvest deficiency period in destination countries.

Partner: The Institute of Rural Economy (crop protection department) in relation with CIRAD-FLHOR, if the case arises.

III.3.2. *Mango production: designing an integrated control method for fruit flies*

Fruit flies constitute an important factor for rejection of mangoes at the entry point in importer countries, or a reason for forbidding fruit imports from Mali. These pests also cause considerable production losses.

It is therefore necessary to identify and implement programs to control these pests, based on integrated management principles and which meet regulatory requirements regarding maximum limits of phytosanitary product residues in importer countries.

The control method, designed in the Reunion Island by CIRAD-FLHOR, may be adapted to West African conditions.
Proposed solution: designing tests during the next mango campaign (year 2000).

Partner: IER in collaboration with CIRAD's FLHOR department and, if the case arises, the Ivorian research station in Korhogo (IDEFOR-DFA).

III.4. Definition of a code of health practice for fruit and vegetable drying (mangoes particularly) including a risk and critical point analysis (HACCP).

The "Groupement des Sécheurs du Mali" (GSM - Malian dryers' group), a GIE composed of 13 partners (possessing a total of 18 dryers) has defined a common schedule of conditions. The partners intend to implement a common marketing policy which should lead to the establishment of a common trademark.

The GSM schedule of conditions probably needs modifications in order to integrate minimal hygiene rules expected by European clients (specialized storage facilities for "health" products, products reported to "derive from Biological Agriculture" compliant with the modified CE Regulation No.2092/91, natural products (so called in reference to the lack of any transformation).

The schedule of conditions for mango dryers should take into account:
- the quality of raw materials (from non-treated farms or those treated through an integrated method respecting the principles of phytosanitary practice);
- the design and installation of dryers (partially covered by the present schedule of conditions);
- Hygiene rules related to the maintenance of facilities and premises (these rules should meet, to the extent possible, the requirements of Guideline 93/43/CE);
- Hygiene rules applicable to staff;
- An analysis of the mastery of treatment techniques (HACCP);

The main risks identified for drying activities include the following:
  - contaminated raw materials (pesticide residues);
  - contamination by pollutants while being washed (at reception);
  - contamination when cutting mangoes (insects, staff, non-disinfected cutting tool);
  - contamination by chemical pollutants during storage after drying;
- Finally, definition of drying processes (temperature monitoring, duration, etc.).

Proposed solution: To provide support to the GSM for improvement of the existing schedule of conditions, taking into account:
- hygiene rules required by importer countries (the European Union particularly);
- the definition of standardized procedures for drying mangoes produced by GIE members.

Support from a technologist specialized in fruit drying is essential. Such technical support may be provided by CIRAD exSAR or any other organization having experience in fruit drying with gaze.

III.5. To organize an evaluation and monitoring system for the quality of Malian products at arrival in destination countries (the European Union particularly).

This monitoring system will help exporters receive information about the quality of their products at arrival and, if necessary, to take adequate corrective measures. This was initiated by CAE during the 1998-99 French bean campaign. This control system should be sustainable and extended to other products.

It should also include:

- a compliance evaluation for the whole set (labeling, net weight, product freshness, grading, etc.);
- a phytopharmaceutical product residue research, if the case arises, in order to identify eventual problems at this level;
- an aflatoxine research for dry products.

These monitoring activities should be organized on a voluntary basis and concern a few sets per campaign. Their objective, on the one hand, is to provide exporters undergoing this control with precise information on the compliance of their products with importing countries' requirements, and on the other hand, to collect data on the quality of Malian products in European markets and thus determine common corrective action to be taken.

A non-exhaustive list of officially recognized European laboratories that could be used to perform phytopharmaceutical product residues monitoring, is provided for information in the last part of this report.

III.6. Support to grain exporters (fonio, sesame, etc.)

Grain exporters/transformers should also define a code of conduct in grain storage and handling.

Support from a technologist specialized in grain storage is needed to determine the code of conduct and to train exporters'/ transformers' staff in stock quality control.

Laboratory tests for aflatoxine research may be successfully performed, although countries in the sub-region targeted for grain exports have not yet adopted any law in this respect.

IV. RECOMMENDATIONS FOR CAPACITY BUILDING WITHIN THE CVL TOXICOLOGY UNIT

IV.1. To define a national policy for evaluation of the impact of phytopharmaceutical product residues on public health and environment.

Mali should record in its national law the MRL of the *Codex Alimentarius* and implement annual evaluation programs for pesticide residues on and within food products.

These programs would help obtain information about the health security of Malian agricultural products on the one hand, and on the other hand, help the toxicology unit of CVL perform routine analyses (500 to 600 analyses per year is the minimum for a control laboratory) thus allowing them to rapidly gain (i.e. is within three to four years) considerable experience in residue research.

IV.2. To provide necessary funding for the implementation of surveillance programs.

These programs, which are part of a national control policy, should be financed through the national budget.

A specific budget should therefore be allocated to the toxicology unit for this purpose (see paragraph II.3 in this Chapter).

IV.3. Capacity building strategy for of CVL's toxicology unit

IV.3.1. *Provision of premises that meet standard quality requirements*

The toxicology unit should possess at least four rooms and a warehouse for the storage of dangerous products:

- one room serving as washing place;
- one air-conditioned extraction room;
- one air-conditioned instrument analysis room;
- one air-conditioned room for administrative work and document storage;
- one warehouse for storage of dangerous products, that is air-conditioned for better conservation of inflammable products; this facility must be physically separated and isolated from the analysis room and should be easily accessible.

IV.3.2. *Provision of equipment*

The laboratory should be equipped with essential equipment for its operation as soon as possible:

- autonomous UPS and electric generator;
- conservation material (refrigerators and freezers) for separate storage of samples, reagents and standards.

A comprehensive list of materials to be secured, along with estimated costs, is provided in Annex II.

IV.3.3. *Staff training*

The staff should be trained in:

- utilization of available equipment (chromatographs gaze phase [CPG])
- result interpretation;
- laboratory management according to quality insurance principles.

<u>Training for the laboratory chief</u>

Three month training in an international laboratory (for example, Virginia Tec laboratory in the United States with which the CVL has work experience).

This training should help gain practical experience in overall operation of a pesticide residue analysis laboratory (manipulation of instruments, result interpretation, laboratory organization, data recording).

<u>Training for the assistant to the laboratory chief</u>

Two month training in an international laboratory. As a result of the training, the assistant should be

familiar with overall routine activities of laboratory operation.

Training for the laboratory technician

Two month in a sub-regional laboratory (for example, the ecological laboratory in Korogho).

Training for the technician should be focused on:
- sample management (reception, conservation and data recording);
- performing extraction activities;
- instrument analyses.

IV.3.4. *Technical assistance and activity follow-up*

Technical assistance will be necessary to organize the laboratory according to the *Codex Alimentarius* recommendations and for its smooth running.

Consultant profile: analytical chemistry specialist with extensive experience in pesticide residue analysis and possibly, some knowledge of the sub-region.

Duration: 12 months distributed over three years in thirteen to fourteen missions, with a first mission of six weeks to organize and start-up the laboratory, then a series of two week missions every two to three months to assess progress, supervise laboratory operation and prepare for implementation of the quality approach.

A planning for implementation of the strategy is proposed in Table 3 below.

CHAPTER 3

STUDIES

I. Malian fruit and vegetable exports

Malian fruit and vegetable exports mainly concern two products: French beans and mangoes.

The main destination countries are European Union member countries.

II.1. The "French bean" sector

The potential market for Malian export French beans is estimated at 2000 tons per year. During the 1998-99 campaign, the exported volume was estimated at 450 tons, while it had reached 700 tons during the preceding campaign (source: CAE).

The sector includes a dozen exporters and more than 3000 producers linked to exporters through more or less formalized contracts. Inputs needed for production (seeds, fertilizers, phytopharmaceutical products) are generally provided to producers by the exporters. A few exporters perform phytosanitary treatment themselves.

One characteristic of the production is its very low level of support. Very little phytosanitary treatment is performed (an average of one treatment by agricultural cycle during the flowering period, or ten to fifteen days before harvest, with products made of deltametrine most of the time or again from an association of fenitrothion and fenvalerate). There is no specific supporting organization to provide support to French bean producers and other products intended for exportation.

The exportation campaign spreads over five months (November through March).

In Mali, the agricultural cycle of French beans lasts about 60 to 70 days, depending on the species, with flowering occurring 30 days after planting, the first harvest occurs about two weeks after flowering starts. Harvesting time lasts about 20 days.

Fertilization consists in bringing organic materials (cow pats or household waste) and mineral "cotton" fertilizer (of NPK 15-20-20 type).

II.2. The mango sector

Mango is a traditional product in Mali. A large portion of the production is locally consumed. About one thousand tons are exported per year (source: CAE).

Here again, the sector has a low number of exporters (about a dozen) and a large number of producers. Mango production is essentially a fruit picking economy. Almost no input (fertilizer or phytopharmaceutical products) is needed.

Fruit flies (*Ceratitis cosyra*, particularly) are the main pests that affect mangoes. These pests are considered as "quarantine" organism by numerous countries (including most European countries in the geographical sense, the United States and Canada). It seems that there is no existing program in Mali to control fruit flies (monitoring of the population, phytosanitary treatment, etc.). Certain producers reportedly perform treatment with insecticides to control fruit fly populations. The chemicals utilized are said be made of diazinon or a mixture of fenitrothion and fenvalerate.

Mango anthracnosis, a conservation disease, is not a problem in Mali, probably because harvesting occurs before the rainy season, the better period for development of this infection. It seems that no exporter performs post-harvest fungicide treatment.

Flour caterpillar populations may also affect the quality of fruit. These homopterous pests have considerably developed in Ivory Coast and presently infest a large number of Ivorian mango orchards. Considering their dissemination capacity (through the wind particularly), these pests may rapidly develop in Mali in a near future.

II.3. Organizing the profession

In Mali, the profession of fruit and vegetable exporter is regulated by the Ministerial decision No.95/MFC-CMDT-MTPT. This decision defines the obligations to be met by exporters. Article 2 of the decision particularly states that exporters "... are required to possess weighing and grading instruments as well as adequate storage, conservation and conditioning facilities that are approved by relevant services[6] or any other institution designated for this purpose."

However, this decision is not enforced. Few exporters have access to appropriate facilities for fruit and vegetable storage and conditioning. Only one exporter, based in Sikasso, possesses a cold room. Exporters who do not have access to specific cold rooms keep their products in refrigerated rooms in Bamako slaughterhouses, which is unacceptable according to of hygiene rule in force within the European Union.

Exporters are organized, at least for some of them, into a private law professional association called AMELEF. Membership and participation in the association's activities are on a voluntary basis.

II.4. Regulatory difficulties encountered by Malian products in international markets.

II.4.1. *French beans*

The main difficulties that affected Malian French beans at entry into the European Union included the following:

- non compliance with the Community phytosanitary requirements (presence of the *Helicoverpa armigera)*. In this case, the merchandise is either rejected or destroyed (in

[6] The General Direction of Regulation and Control (DGRC) of the Ministry of Rural Development and Water is the relevant authority for these matters.

principle, the decision is made by the importer);

- non compliance with quality standards. In this case, measures taken generally concern product downgrading, sorting and reconditioning, if the case arises, extremely severe sanction being turn back or destruction of the merchandise.

II.4.2. *Mangoes*

Numerous loads of mangoes were turned back at various community entry points for non compliance with phytosanitary requirements, that is, either the lack of or non-conformity with the phytosanitary certificate, or the presence of fruit flies. The table below indicates the evolution of Malian mango interception due to non-European *Tephritidae* infections (interceptions for lack of or non-conformity with the phytosanitary certificate are not accounted for).

Evolution of Malian mango interception from 1996 to 1999 due to fruit fly infections (source: OEPP[7] information service)

Year	1996	1997	1998	1999
Number of lot?	9	6	1	*

*** Data not available**

Problems related to the commercial quality of fruit are also reported (over-ripened, inappropriate labeling, etc.). To-date, no problems related to excess prevalence rate of phytosanitary product residues have been reported.

III. EUROPEAN UNION REGULATORY CONSTRAINTS

Within the European Union, fruit and vegetable sales and imports are regulated by various laws.

Dispositions governing the Common Organization of Markets (COM) for fruit and vegetable are not considered below because these are outside of our scope of work.

III.1. Phytosanitary control

Modified Guideline 77/93/CEE determines measures aimed at preventing the introduction of plant and vegetable pests into the European Community.

Annex V.B of the Guideline provides the list of plants and plant products which should be subject to compulsory phytosanitary control at import into community territory. These plants and plant products should carry a phytosanitary certificate, in the sense of the International Convention for Plant Protection, delivered by phytosanitary authorities of the originating country.

Within the European Union, mangoes are subject to phytosanitary control at importation. They must

[7] *OEPP = "Organisation Européenne et méditerranéenne pour la Protection des Plantes".*

be certified as being free of pests listed in Annex I.A of Guideline 77/93/CEE, and particularly the non-European Tephritidae (fruit flies).

French beans are not mentioned in the list of plants and plant products that are subject to phytosanitary control at importation. Therefore, they may be introduced into the community territory without any phytosanitary certificate. On the other hand, they must be free of any pests listed in Annex I.A of the Guideline (particularly, caterpillar of the *Helicoverpa armigera* species, which is frequently encountered in West African vegetable crops, and to a lesser extent, aleurods of the *Bemisia tabacci* species, which are mostly encountered on vegetable leaves).

Palettes, palette-boxes and other loading plates made of conifer wood are also subject to phytosanitary control at entry into the European Community. Simple palettes and palette-boxes (code NC ex 4415 20) are exempted from phytosanitary certification in the country of origin if they are in conformity with standards applicable to "UIC palettes" and if they carry proof of such conformity.

III. 2. Conformity control

The modified EEC rule No.2251/92 institutes a compliance control for fruit and vegetable marketing.

Businessmen who have been implementing a self-control system that guarantees that they are able to insure a constant quality for their products may be exempted from control at expedition, according to methods determined by article 6 of the above mentioned rule.

Fruit and vegetable imports from third party countries and which are intended to be consumed while fresh, are subject to compliance control instituted by article 1 of Rule No.2251/92.

For products imported from third party countries, fruit and vegetable must comply with common quality standards, when such standards exist, or with standards that are equivalent at least.

Article 9 introduces the concept of official control service approval in third party countries, which help carry-out the compliance control before expedition (that is, in the country of origin). In this case, merchandises imported from the third party country whose official control service was approved as mentioned above, are exempted from control at the community entry point, if these merchandises carry a control certificate delivered by this service. However, regular controls should be carried-out at the entry point by relevant authorities of Community member countries to ensure compliance of products imported from concerned third party countries.

III.3. Food product hygiene control

III.3.1. General information

Food product control within the European
Union was instituted by Guideline 89/387/CEE. Guideline 93/99/CE then determines additional control measures and particularly specifies in its article 3 that laboratories used for official

controls must be accredited with appropriate European standards by November 1st, 1998 latest.

Revised Guideline 93/43/CEE determines general food hygiene rules and verification methods for these rules. This law is horizontal and concerns all food products, including fruit and vegetable, both fresh and transformed.

According to this guideline, food sector enterprises should take appropriate security measures based on the principle of the HACCP[1] system. This statement makes entrepreneurs bear penal responsibilit in case of deficiency.

Section IX.1 in the Annex states: "Food sector enterprises should not accept any ingredient or raw material which is known or for which there are sound reasons to suppose that they are contaminated by parasites, pathogenic micro-organisms or toxic substances,...". This implies that entrepreneurs are responsible for taking all measures needed to ensure health security of the raw materials.

Statements of Guideline 93/43/CEE (and particularly hygiene rules stated in the annex) apply to enterprises in European Union member countries, but are not mandatory for third party country enterprises.

Regarding imports from third party countries, article 10 mentions that in case a serious problem arises in or extends to a third party country, affecting human life, the European Community may take action forbidding imports totally or partially, or determining particular conditions for imports.

This statement was recently applied three times for products of plant origin:

1. Decision 98/116/CE determining particular measures for fruit and vegetable imports from Uganda, Kenya, Tanzania and Mozambique (due to a cholera epidemic). This decision was abrogated by decision 98/179/CE;
2. Decision 97/613/CE which temporarily banned "pistachio" imports originating or coming directly for Iran (due to high prevalence rates of B 1 aflatoxine); and
3. Recently, Decision 1999/356/CE date May 28, 1999 which temporarily suspended importation of peanuts and some derived products originating or directly imported from Egypt (JOCE No.L 139 date June 6, 1999).

Consequently, enforcement of measures determined by Guideline 93/43/CEE by agro-food sector enterprises in third party countries wishing to export their products towards the European Union, is highly recommended in order to anticipate enforcement of article 10, affecting all entrepreneurs in the concerned country.

III.3.2. Pesticide residue monitoring

Principles

8. HACCP = Hazard Analysis Critical Control Points.

General principles for pesticide residue monitoring within and on fruit and vegetable are defined by Guidelines 89/397/CEE and 93/99/CEE.

Controls must be carried-out either regularly, or in case compliance is doubtful. This control is perhaps done at all points in the sector, from production or exportation (it should be noted that for pesticide residues, community MRL apply to products intended for exportation towards third party countries, except if this country requests such a treatment that makes it impossible to meet community limits).

Guideline 93/99/CEE specifies that laboratories responsible for official control of pesticide residues should be accredited with European standards (namely BPL or equivalent) from November 1st, 1998 onward.

Consequently, community law does not require from member countries to carry-out specific residue controls at importation, however, this is not forbidden. On the other hand, in virtue of section IX.1 in the annex of Guideline 93/43/CEE (see III.3.1. above), entrepreneurs are required not to accept food products that are contaminated by toxic substances, including phytopharmaceutical product residues.

In practice, pesticide residue evaluation programs within and on food products are conducted by member States. These programs concern Community products as well as products from third party countries (which are subject to sampling either at the entry point or at a lower point in the sector). The content of these evaluation programs is determined taking into account health risks related to the nature of the product, prior information learned about non compliance cases, in the country of origin, if the case arises[1].

Setting maximal residue limits

Maximal limits for pesticide residues (MRL) on and within fruit and vegetable are determined by Guidelines 76/895/CEE and revised 90/642/CEE.

Sampling methods are determined by Guideline 79/700/CEE[1].

MRL are determined with the goal of preventing any human and animal health risks but also to preserve the environment, making sure that phytopharmaceutical products are utilized in conformity with good agricultural practices. For this reason, MRL are determined at the lowest possible level and do not constitute toxicological limits (they should however be accepted in the toxicology point of view). When there is not authorized utilization for a given phytopharmaceutical product and for a given crop, the MRL is set at the limit (or near the limit) of the analytical determination threshold.

Consequently, for products intended for exportation, entrepreneurs must obviously consider national law governing the use of phytosanitary products ("national approval" or sub-regional

9. See European Commission Report: "Pesticide residue monitoring within the European Union and in Norway: 1996 report".

10. A copy of this guideline was provided to the CAE information service.

approval, as it is in CILSS[1] member countries), but also verify that authorized conditions for utilization help meet destination country requirements regarding pesticide residues.

III.3.3. *Controlling additives, colorings and conserving matters used in food product processing*

The use of additives, colorings and conserving matters is regulated by several Community guidelines (Guideline 94/35/CE, Guideline 94/36/CE and Guideline 95/2/CE).

These dispositions have little effect on fruit and vegetable for which, in principle very little additives, colorings and conserving matters are used for fresh products.

However, some post-harvest treatment for fruit are taken into account in Guideline 95/2/CE. Presently, no chemicals are authorized for the treatment of mangoes after harvest (fungicide treatment for conservation, for example). Treatment of mangoes after harvest by soaking into fungicide pulp should therefore be forbidden if authorized MRL are exceeded.

III.4. Summary of main Community dispositions affecting the two sectors in Mali (mangoes and French beans).

- The phytosanitary certificate in the sense of the International Convention for Plant Protection, is the only control document issued in the country of origin, as required by Community law. The phytosanitary certificate is required for mangoes but not for French beans. The list of tropical fruit subject to phytosanitary control at importation within the European Union is provided in Annex III.

- Fruit and vegetable originating from third party countries are submitted to quality control at importation. They should comply with European quality standards, if such standards exist. To-date, there is a standard for French beans, but not for mangoes.

- Fruit and vegetable may be exempted from quality control at importation, if there is an organization which is officially approved by Community institutions and which performs the control before exportation.

- Fruit and vegetable originating from third party countries must meet Community safety requirements:
  - absence of any parasites, pathogenic micro-organisms, toxic substances, which may render the products inappropriate for consumption. Importers, as food sector enterprises, are legally responsible for the safety of products they sell;
  - respecting maximal residue limits for phytopharmaceutical products;
- respecting maximal limits determined for other contaminating matters such as heavy metals, nitrates and aflatoxine.
  NB: there is no reason à priori for French beans and fresh mangoes to be contaminated by these other contaminating matters.

11. CILSS = "Comité permanent Inter-états de Lutte contre la Sécheresse au Sahel" (permanent inter-state commission for drought control in the sahel), of which Mali is member.

- The European Commission may forbid or restrict fruit and vegetable imports from third party countries, in case a serious hygiene problem which may threaten human life, arises in the country of origin. Such measures used to be enforced in the past for other African countries due to cholera epidemics.

A list of Community legal texts is provided in Table 1 below.

III.5. Regulatory requirements in other countries in the sub-region regarding plants and plant product imports

III.5.1. Phytosanitary requirements

Most countries in the sub-region have incomplete phytosanitary regulations: no list of quarantine organisms, no detailed list of requirements at import.

It seems that the rule for sub-regional countries is to request a phytosanitary certificate from the country of origin or, if the case arises, a re-exportation phytosanitary certificate, whatever the country of origin, for any plant or plant product. These dispositions may apply to dried products and transformed grains.

III.5.2. Health requirements (phytopharmaceutical product residues and other contaminating matters)

In the sub-region, it seems that only Senegal and Ivory Coast have adopted regulations that determine the maximal limits of pesticide residues on and within plant products. These regulations transcribe *Codex Alimentarius* recommendations in this field.

It appears that no country has determined the limits for other contaminating matters such as micotoxine or heavy metals.

No information related to food product hygiene in countries of the sub-region has been collected during this mission.

III.5.3. Quality standards

Apparently, no country in the sub-region has yet adopted regulations related to fruit and vegetable commercial quality. International reference standards to be taken into account are either Codex Alimentarius or CEE/UNO standards.

The list of international reference to be taken into account for Malian plan and plant product exports in the sub-region is provided in Table 2 below.

III.6. Regulatory requirements for importation of plant and plant products in the United States

In the United States, agricultural products coming for third party countries are subject to several

restrictions.

Numerous products are banned for imports due to phytosanitary reasons (for example, West African mangoes due to the presence of a species of fruit flies which does not exist in the United States). The opening of American markets to West African mangoes may occur, provided that measures defined by NAPPO[1] phytosanitary standard be enforced regarding quarantine surveillance measures for fruit flies in one part of an infected region.

For several products presenting high phytosanitary risks, an importation license needs to be obtained from the agricultural department (USDA). A limited list of products may be introduced without importation license.

Regarding the control of phytopharmaceutical product residues and other chemical contaminating matters, a surveillance program is establish each year which deals with both national production and imported products. Pesticide residue control is the responsibility of the Food and Drug Administration (FDA).

The principle of phytopharmaceutical product residue control is similar to the one applied in the European Union. FDA defines surveillance programs which consist in taking samples at all levels, from production to distribution. In case of suspected fraud, more targeted controls may be performed. Imported products are also submitted to a surveillance program. Samples are taken, but the merchandises are not blockaded except in the case of suspected fraud[1].

IV. Food product control in Mali

IV.1. Legislation

IV.1.1. Phytosanitary monitoring

Phytosanitary monitoring does not concern actual food product control. It concerns the monitoring of plants and plant products at the national and international levels (import and export) in order to prevent spreading of plant and plant product pests. Because of constraints on Malian fruit and vegetable exports, this aspect is however included in the chapter about "Food product monitoring".

Phytosanitary controls are governed by law No.95-062 about repression of infractions to the regulation of plant protection and decree No.95-403 about regulation of plant protection.

Decisions regarding technical application (lists of quarantine pests, list of phytosanitary requirements at importation, list of plant and plant products which are banned for importation) have not been promulgated. Consequently, Malian phytosanitary legislation is not applicable.

It is worth noting that the lack of appropriate phytosanitary legislation, may be a constraint to the

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12. NAPPO = North American Plant Protection Organisation.

[13] See report "Residue Monitoring 1998" Food and Drug Administration – Pesticide Program.

development of Malian agricultural product exports. In fact, some countries may justify the ban on Malian imports by the lack of information about Mali's status vis-à-vis certain quarantine pests and the lack of appropriate regulatory measures aimed at preventing the introduction of unknown pests in the region.

As for Malian exports, these are submitted to mandatory phytosanitary control, even if the destination country does not require this control (the case of European Union for French beans). Phytosanitary control does not need to be compulsory and may, in certain situations, constitute a non-quality factor for exportation.

Phytosanitary controls are performed at various points the most important of which is located at the Bamako airport (main entry and exit point).

In order to facilitate exports, it would be highly recommendable that phytosanitary control (for mangoes particularly) be performed at conditioning facilities or at the mango orchard level through monitoring of Tephritidae populations through ad-hoc trapping networks.

IV.1.2. Quality control for packaging materials

Quality and conditioning control is regulated by a decree dated 1962 (Decree No.66/PG-RM). This decree refers to application texts which, apparently, have never been promulgated.

Two draft decisions determining Malian standards regarding French beans intended for exportation on the one hand and mangoes intended for exportation on the other hand, are under preparation. These draft regulatory standards take into account international references in this respect (EEC/UN standards). Draft ministerial decisions plan to make these standards compulsory for mangoes and French beans exported from Mali. The authority responsible for controlling is the DGRC of the Ministry of Rural Development and Water.

It should be noted that enforcement of a mandatory administrative control at export may be a constraint to accessing certain markets whose quality requirements may not be in conformity with Malian standards, on the one hand, and may be a bureaucratic handicap for exports and thus penalize the most performing entrepreneurs.

On the other hand, the reputation of Malian products in the international markets will undoubtedly improve, if a national policy aimed at improving the quality of Malian export products were implemented.

IV.1.3. Controlling food product hygiene

There is no horizontal law in Mali relating to the control of food product hygiene. A bill of law determining the conditions for production, collection, transformation, conditioning, transportation and marketing of milk and other milk products is reportedly under preparation, as well as an application decision defining the standards and quality control for milk and milk products (source: FAO Report, September 1998, Ezzedine Boutrif).

There is no specific regulation related to maximal limits of phytosanitary product residues and

other contaminating matters. Apparently, neither is there a regulatory definition of the water safety. A draft ministerial decision determining minimal standards for water intended for human consumption is under preparation. This draft decision is said to be based on the World Health Organization's recommendations.

IV.2. Controlling institutions

Three ministries are responsible for food product quality control, including sanitation control: the ministry of rural development, the ministry of health and the ministry of industry.

Within the Ministry of Rural Development and Water, the general direction of regulation and control (DGRC) is responsible for control activities (health, veterinary and phytosanitary control as well as conditioning control).

Two laboratories are involved in the sanitation control for food products: the National Health Laboratory (NHL) and the Central Veterinary Laboratory (CVL).

The NHL was established through support from the European Development Fund (FED) and its mission is to control medicines, food products, water and drinks. However, its main activity remains the control of medicines.

The CVL was created with support from American bilateral cooperation (USAID) and its mission is to perform veterinary controls, food product control (microbiological control and the control of toxic materials such as phytopharmaceutical product residues). The toxicology unit which is responsible for researching chemical polluting products, is not currently operational.

V. Creation of a quality label for Malian agricultural products

V.1. Various types of food standards

Food standards may be compulsory or voluntary.

They may be resource standards, that is those which help define systems to be used so that the product targeted meets the requirements, or else they may be result standards, that is those which determine precise characteristics to reach.

A standard may also be horizontal, if it applies to an element that is common to all products (for example, common rules for labeling). A standard will be qualified as vertical when it brings together all dispositions applicable to a product category.

V.2. The principle of agro-food product quality control and its evolution

V.2.1. Traditional approach for food product quality control

The traditional approach to food product quality control consisted, for a long time, in defining minimal conditions for preparing and equipping facilities, staff and material hygiene rules and minimal limits for the prevalence of certain microbiological and chemical contaminating materials. Control was regularly performed by official services which verified, particularly through sample taking and laboratory analysis, compliance with limits set by the regulation.

In case of food intoxication, an investigation was rapidly carried-out in order to determine the origin of contamination on the one hand and, on the other hand, to verify if the entrepreneur had fulfilled his obligations. If he had, he no longer had any responsibility.

V.2.2. Limits of the traditional system

The traditional system of control and certification of food products helped determine minimal rules to be enforced:

However, this system presents some weaknesses including the following:

- determining restrictive lists in the field of technological processes, equipment, etc., which reduces innovation opportunities;
- regulatory texts are sometimes not precise/clear;
- limitation of the use of laboratory analyses due to the impossibility to research all potential contaminating materials (bacteriological, chemical and others), possible heterogeneity of contamination within the same set of product, the impossibility to take a representative sample due to economic reasons, and finally, the deadlines imposed by the analyses, which may surpass the lifetime of the product.

Moreover, its enforcement is not compatible with the development of international trade nor with recent World Trade Organization accords.

V.2.3. Evolution of control systems: towards self-control

To fill the gaps in the traditional control system, it was necessary to make entrepreneurs responsible for mastering skills to ensure quality and perform surveillance of manufacturing activities. Then administrative authorities are simply responsible for the evaluation and approval of control systems implemented by entrepreneurs.

This is why quality control is more and more left to professionals. The legislator sets-up a result obligation for them to achieve.

The *Codex Alimentarius* Commission's 1992 report states that as part of the GATT accords, particularly the accord on sanitary and phytosanitary measures, it appeared necessary *"to harmonize food product control and certification systems based on sound professional principles, in order to define conditions that help establish confidence between various commercial partners, which will facilitate international trade and contribute to the achievement of progress in health and hygiene"*.

The system which is internationally recognized as being efficient to ensure food safety is the HACCP system. Codex Alimentarius recognizes it as the best tool to ensure food safety.

V.3. Creation and recognition of a quality standard.

The adoption of a code of healthy conduct may, on the other hand, lead to a national or international certification (ISO 9002 certification for conditioning stations for example).

If it does not lead to certification, its enforcement would depend on the good will and seriousness of entrepreneurs. It may be used for marketing purposes in order to promote a given brand.

If it leads to national certification with international recognition, it will then be essential that entrepreneurs who wish to be certified commit themselves to control to be performed by an independent and neutral certifying organization whose qualifications are recognized by all actors in the sector (producers, exporters and importers).

V.3.1. Profile of the certifying institution

The certifying institution or auditor should have the following qualifications:

- good knowledge of horticultural products, particularly agronomic skills (for the certification of entrepreneurs in the fruit and vegetable sectors);
- experience in the relevant sector;
- knowledge in food hygiene and quality control (HACCP approach);
- recognized skills in quality auditing.

The auditor must also be recognized by both importers and exporters as being independent and loyal. To be recognized by importers, it is essential that the auditing institution possess international accreditation.

V.3.2. Various options for a Malian certifying institution

Private international company in charge of controlling (Véritas or SGS[14] type)

Generally, these companies have an international good reputation and could be accepted by importers and exporters as independent organizations.

On the other hand, however, it seems that these organizations have not acquired enough experience in quality insurance nor in horticultural product management.

SGS works in Mali. Their controlling activities mainly consist in taking samples analyzed in laboratories of their choice. In Mali, they seem not to have experience with quality auditing, nor skills in the horticultural and agronomic issues. On the other hand, SGS possesses an excellent network of laboratories with international reputation and may therefore be perfectly utilized by exporters to perform laboratory analyses whenever necessary.

[14] SGS = Société Générale de Surveillance

The other company, Véritas, also has a commercial branch in Mali. Their current activities in Mali consist mainly in providing authorization for building construction.

The main disadvantages of using an international auditing company include the following:

- - the costs may probably not be affordable for entrepreneurs;
- lack or weak level of expertise in the horticultural sector.

Malian certifying institution: the CVL toxicology unit

The CVL may possibly play the role of certifying institution, with an external accreditation.

As a public institution, it should be able to gain recognition by exporters as independent and neutral control organization. To be perceived as such by entrepreneurs in foreign countries, it will be essential for the CVL to obtain an external accreditation as auditing institution.

The second advantage for entrepreneurs is the relatively low cost for utilizing a local auditor.

However, the toxicology unit of CVL is a laboratory whose vocation is to perform physico-chemical analyses (pesticide residue research, research of chemical contaminating materials such as mycotoxine, dioxin, heavy metals, etc.).

Consequently, the CVL does not possess needed skills in quality insurance, business auditing nor knowledge in agricultural sectors. On the other hand, the toxicology unit may eventually become a service provider for exporters, particularly for pesticide residue analyses and aflatoxine research. However, the toxicology unit should first demonstrate capacity to deliver reliable and high level services on the one hand and, on the other hand, obtain a quality accreditation so that its results may be accepted by importers and third party country officials.

Professional Association (AMELEF for example)

A professional association may become an auditing institution.

The advantage would be the relatively low costs for exporters. In addition, AMELEF has a certain knowledge of horticultural products.

To guarantee independence and neutrality for auditing activities carried-out by a professional association, an external accreditation will be essential.

However, AMELEF is not representative of all Malian fruit and vegetable exporters. In addition, it does not possess auditing skills.

The AMELEF could become an auditing institution, provided that they create a "quality insurance" unit with permanent staff trained in quality auditing and having agronomic knowledge of horticultural products. This approach may be initiated by the creation of an agronomic service within AMELEF which would be responsible for providing support to raw material suppliers and

verifying that the schedule of conditions is respected.

However, for a Malian auditing institution, the smaller the number of entrepreneurs to be certified, the higher its operating costs will be. This should obviously be taken into account when identifying a final certification strategy.

VI. Evaluation of the toxicology unit of CVL

VI.1. CVL administrative organization

The Central Veterinary Laboratory has been designated as a public administrative company ("Enterprise Publique à caractère Administrative - EPA") since 1994. It enjoys financial and management autonomy. The Malian government provides 30% of its operating budget which is essentially designed for salary payments, 10% is provided by external partners (projects) and 60% from its own resources (service delivery and vaccine sales).

The toxicology section is part of the Diagnosis and Research Division which includes 12 sections and units. This division's mission is:
- applied research in animal health;
- routine and reference diagnosis;
- microbiological quality control for animal origin food products;
- controlling and sanctioning the import of toxic wastes (Decree No.90-355/PRM dated August 8, 1990);
- training in laboratory techniques and retraining for field staff.

The toxicology section is responsible for the monitoring of pesticide residues and other toxic products within food products of animal or plant origin, environmental surveillance studies (water, soil, sediments, trophical network), ecological follow-up of vector control campaigns (fighting grasshoppers and glossary control).

The CVL staff is governed by the Malian civil service statute. The toxicology unit staff includes the following:
- one veterinary doctor specialized in pesticide residue analysis (chief of the unit);
- one newly graduate veterinary doctor;
- one assistant.

VI.2. The laboratory premises

The toxicology unit has only one room area to perform all tasks related to laboratory operation, including administrative tasks. This does not help it meet quality insurance requirements for which a minimum of four separate rooms and a warehouse for storage of dangerous products is indispensable.

VI.3. Available equipment

The list of available materials at the toxicology unit is provided in Annex IV.

Available material is inadequate to operate the laboratory. Essential consumables are lacking: analytical standards to perform surveillance program analyses, some reagent and solvents.

For the toxicology laboratory to become functional, additional equipment needs to be secured, including the following:
- a UPS and a generator to supplement power shortages;
- a refrigerator and a freezer to allow for separate storage of analytical standards and samples to be analyzed;
- an 800°C muffle furnace;

Later, the following equipment will be needed:
- one mass spectrophotometer;
- one HPLC fluorimetric detector;
- one hydrogen generator;
- one air generator
- one refrigerating centrifuge;
- one incinerator for waste management.

The detailed list of equipment to be secured as well as estimate prices are provided in Annex II.

VI.4. Analytical methods utilized by the toxicology unit

The CVL toxicology unit has a beginner status, as no single analysis had been performed there before the mission was carried-out.

Pesticide residue analyses in various matrices have not been fully installed, however tests were performed on certain matrices during the consultation such as French beans and active matters such deltamethrine and carbaryl.

VI.4.1. Sampling method

The toxicology unit did not possess any sampling method. The Codex Alimentarius method, which is internationally recognized, was provided by the consultant and should be used as reference method.

Other methods may be used, such as the Community method defined by Community Guideline 79/200/CEE, according to the objective aimed at.

For sample taking and conservation, it is also essential that the toxicology unit implement Codex Alimentarius recommendations aiming to preserve sample integrity or any other equivalent arrangement.

VI.4.2. Extraction methods

The laboratory has AOAC methods. The DFG[15] methods were provided by the chemistry specialist consultant.

During the mission, these different methods were adapted to the following biological matrices:
- extraction protocol for meat, fish and crustaceans;
- extraction protocol for eggs;
- extraction protocol for milk;
- extraction protocol for cereals, herbs and flours;
- extraction protocol for bananas;
- extraction protocol for sediments and soils;
- extraction protocol for water;
- extraction protocol for plants (fruit and vegetable).

These methods are now available at the laboratory and should be considered as confidential documents pertaining to the laboratory.

VI.4.3. Instrumental analysis

The laboratory is equipped to perform detection for principal phytopharmaceutical product families including the following:
- organochlorea
- organophosphorea
- pyrethrinoids,
- carbamates;
- others such as diflubenzuron, metolachlore, terbutryne, dimethametryne, pretilachlore, thirame, asulame, oxadiazon, isoprothiolane, chlorophacinone, atrazine, trichlorfon.

However, the laboratory does not have analytical standards.

VI.4.4. Result interpretation

To be able to interpret results, the toxicology unit must have access to international and national references regarding maximal residue limits:
- MRL recommended by the Codex Alimentarius;
- MRL of third party countries, such as harmonized MRL in the European Union, the United States MRL, etc.;
- as well as the regulatory requirements of major importing countries for Malian agricultural products.

Given that these references are continuously evolving, it is essential that the toxicology unit develop an information system that helps it have permanent access to up-dated data. Therefore establishment of an information service is essential for proper operation of the laboratory.

VI.5. Laboratory operating cost estimates

[15] DFG = Deutscheforshungsgemeinschaft.

Annex V presents estimates for operating costs, taking into account additional equipment and consumables to be secured.

Total cost for the analysis of a sample for pesticide residue research is estimated at an average of 35,000 CFA. For a multi-residue analysis, the cost is about 50,000 CFA and varies according to the matrix.

Calculation of these costs does not take into account the additional costs which will be induced as a result of the BPL quality certification or equivalent (increased operating costs, recruitment of a quality insurance officer, annual audits by a certifying institution).

Chapter 4

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II. Other sources of information

- OEPP information service: OEPP newsletter, accessible through Internet subscription. Messages can be sent to the following address:
  Join Reporting
  eppo_doc@eppo.fr

The newsletter is thus sent by e-mail each month (in both French and English).

- Legislation of European Economic Communities
  http://europe.eu.int/eur-lex

- Information about the DGXXIV (General Direction of the European Commission in charge of consumer protection). http//europe.eu.int/comm/dg24/

  Community inspectors' inspection reports are available at this address.

- Information about phytosanitary requirements at import in the United States. http://www.aphis.usda.gov

- Information about sanitary requirement in the United States: http://vm.cfsan.fda.gov/list.html

(Site of the Food and Drug Administration).

http://www.fsis.usda.gov (Site of the Food Safety and Inspection Service).
http://www.fas.usda.gov/imprograms.html (Site of the Office of Food Safety and Technical Service)

- FAO site allowing to consult FAO data on Codex Alimentarius recommendations regarding phytopharmaceutical product residue maximal limits. http://www.fao.org

- Site of the World Trade Organization http://www.wto.org

- Fintrac Inc. regulatory information site http://www.fintrac.com/gain/regs/

  Information on regulatory requirements of several countries including the United States and Canada.

III. CONTACTS

III.1. For implementation of the quality approach

III.1.1. Regulatory information source

Phytosanitary Cooperation Mission
Ministry of Agriculture and Fishing
DRAF Building
P.O. Box: 7309
34090 Montpellier Cedex 4
tel: +33(0)467 75 30 90
fax: +33(0)467 03 10 21
E-mail: mcpfrance@wanadoo.fr

III.1.2. Additional technical assistance

CIRAD
Fruit and vegetable department (FLHOR)
M. Jean Pierre Gaillard
Tel. +33(0) 467 61 58 59
Fax +33(0) 467 61 58 77
Email: jean-pierre.gaillard@cirad.fr

Fruit and vegetable drying
M. Thierry Goli
Tel. +33(0) 467 61 57 16
Fax. +33(0) 467 61 44 49

Email: thierry.goli@cirad.fr

Cereal storage/transformation
M. Jean François Cruz
Email: jean-francois.cruz@cirad.fr
(will take a long term position in Bamako as of September 1999 on a CIRAD project).

III.1.3 *Indicative list of European laboratories officially recognized to perform phytopharmaceutical product residue analyses*

These laboratories may be used to set-up a phytopharmaceutical product residue evaluation program for Malian products.

In France
Laboratoire Central Coopagri Bretagne
ZI de Lanrinou
29206 Landerneau Cédex

Laboratoire LARA
75, voie du TOEC
31300 Toulouse

Departmental analysis laboratory
Tecnosud
Rambla de la thermodynamique
66100 Perpignan

Departmental veterinary laboratory in Sarthe
128, rue de Beaugé
72018 Le Mans Cédex

SGS Laboratoire Crépin
2 bis, rue Duguay-Trouin
76178 Rouen Cédex

CTCPA
41, avenue Paul Claudel
80480 Dury-lès-Amiens

Laboratoires Wolff
20-22, rue Charles Paradinas
92583 Clichy Cédex
Tel. +33 1 41 06 95 85

Fax: +33 1 47 30 40 96

Laboratory in the United Kingdom
RESTEC Laboratories Limited
Birlingham, Pershore, Worcestershire, WR10 3 AA
United Kingdom
Tel. +44 1 386 750 799
Fax +44 1 386 750 017
http://www.restec.co.uk
Email: johnedmunds@resteclabs.demon.co.uk

III.2. For support to CVL toxicology unit.

Potential analytical standard supplier:

Dr. Ehrenstorfer Gmbh - Bgm - Schlosser Str 6a - D-86199 Augsburg.
http://www.analytical-standards.com
Email: info@analytical-standards.com.

ANNEX I
Draft Code of Sanitary Practice for Horticultural Products in Mali

I. Raw material production

Agricultural raw materials may be a source for various types of contamination.

Producers should keep an agricultural record book for each crop in their fields, for the recording of all agricultural activities.

The agricultural record books should be kept for at least three years for annual crops and five years for permanent crops.

I.1. Environmental control

No crop should be cultivated or harvested in places where substances may be transmitted to the food:

- industrial pollution (heavy metals, chemical products, etc.);
- urban wastes;
- others.

I.2. Irrigation water control

Irrigation water must be controlled and recognized free of chemical contaminating matters and microbiological elements that may constitute a risk for the consumer.

Irrigation water analyses must be performed each time potential contamination sources are identified.

I.3. Fertilizer control

I.3.1. Organic fertilizers

The use of compost made of urban wastes must be forbidden.

The use of cesspool wastes must be forbidden.

Manure must be spread for long time that is long enough before crops are sown.

The use of organic fertilizers must be recorded in an agricultural record book kept up-to-date.

I.3.2. Mineral fertilizers

Mineral fertilizers that are utilized should be adapted to the relevant crop and their origin should be known.

They should be free or almost free of heavy metals. It is recommended to use fertilizers that are labeled "EC Fertilizer".

The use of mineral fertilizers should be recorded in the agricultural book which should be kept up-to-date.

I.4. Fighting crop devastators and enemies

A pest control program should be set-up while respecting good agricultural practice. Particular attention should be paid to the control of regulated pests in importing countries and to the enforcement of phytosanitary requirements in these countries.

I.4.1. Selection of phytopharmaceutical products

Phytopharmaceutical products should submitted to national authorization (or sub-regional in the case of CILSS approval).

The purchase of reconditioned phytopharmaceutical products should be forbidden.

Pharmaceutical products must be purchased from reliable cost-effective companies.

A list of phytopharmaceutical products authorized by the code of conduct should be established for each crop. Establishment of this list should take into account sub-regional approval of the Sahelian Pesticide Commission as well as requirements of importing countries regarding phytopharmaceutical product residue analysis.

I.4.2. Utilization of phytopharmaceutical products

Phytopharmaceutical products must be utilized in accordance with regulatory arrangements in force.

The doses, treatment periods, and duration of treatment before harvest, must be specified in the exporters' schedule of conditions.

A process must be established for evacuation of product leftovers in tanks.

Phytopharmaceutical product application must be recorded in the agricultural book with adapted treatment sheets.

Phytopharmaceutical products must be utilized with appropriate equipment.

The treatment equipment should be regularly graded. Treatment equipment maintenance activities must be recorded in a maintenance book specific for each equipment.

The use of phytopharmaceutical products containing the following active materials:
aldrine, dieldrine, chordane, DDT, non purified dicofol,
endrine, HCH, all isomers including lindane, heptachlor, mirex, toxaphene,
should be forbidden for the entire farm.

The staff responsible for application of the phytopharmaceutical products should receive particular training in this subject including the following:

- pulp preparation procedures;
- manipulation of the sprayer;
- procedures to be observed in case the product pours down accidentally;
- elimination of pulp leftovers;
- rinsing the sprayer and elimination of rinsing water;
- security measures related to the manipulation of phytopharmaceutical products;
- how to read a label.

I.4.3. Phytophamaceutical product storage and waste disposal

Storage:

Phytopharmaceutical products should be stored in a locked room which is adequately lighted and reserved for this purpose.

Phytopharmaceutical warehouses must be located in a place that is free of any risks of contamination by water (for example close to a well, river, etc.).

A stock inventory must be kept up-to-date permanently. The products in the stock will be used on first arrived first taken basis, as much as possible.

The products must be stored within their original packaging and in conditions that preserve their integrity, and particularly the integrity of labels.

Adequate equipment should be available in case the products pour down accidentally, in order to avoid environmental pollution.

Waste disposal

Phytopharmaceutical product wastes are of two kinds:
- empty packages; and
- residue and sprayer rinsing water.

An appropriate procedure must be established for the elimination of empty packages and followed-up at agricultural farm level (for example, incineration of paper and cartoon packages, rinsing plastic packages, perforating them to prevent their re-utilization and eliminating/storing them in ad-hoc places).

Package disposal sites should be located away, as far as possible from water sources (wells, rivers, underground water).

Whenever possible, empty packages will be returned to phytopharmaceutical product suppliers.

Residues may be eliminated by dilution and spreading the pulp over the entire crop.

Water for rinsing sprayers will be eliminated at a rinsing spot which is specifically adapted for this purpose (creation of "biobed" type bacterial bed or in an evaporation tub).

I.5. Harvesting

The materials and recipients utilized for harvesting must be constructed and maintained in such a manner not to present any risks for health.

Recipients designed for utilization must be made of materials and according to a design which allow for easy cleaning. They must be kept clean.

The use of recipients which formerly contained toxic products (e.g., phytopharmaceutical products, fertilizers, household wastes, etc.) should be forbidden.

During harvesting, appropriate measures should be taken to prevent raw materials to be contaminated by devastators or external materials and in order to avoid their deterioration.

I.6. Transportation to conditioning/transformation stations

Material transportation and handling methods must be adapted to the relevant raw material. They must be maintained in clean conditions.

During transportation, all caution should be observed to prevent product contamination and degradation. If necessary, the products will be pre-refrigerated.

The time frame for transportation from the farm to the conditioning stations must be reduced to the minimum possible.

II. Characteristics of conditioning stations

Full mastery of conditioning station design and organization techniques constitutes an essential point in product hygiene management.

II.1. Risks

Fruit and vegetable may be contaminated by:
- the environment (air, material, etc.) ;
- the staff ;
- water ;
- wastes.

Products to be peeled or subject to transformation (e.g., cutting, drying) have more risks than crude products.

II.2. Prevention

II.2.1. Location

The conditioning station must be located in an environment which is compatible with its activities.

Particularly, it must be built in a place that is as far away as possible from industrial and agri-business sites, etc.

It must be fenced so as to restrict access to foreigners.

The borders of the station must be maintained in clean conditions, free of garbage, grass, etc.

Organic wastes should be stored in a place which is specifically designed for this purpose and disposed of on a daily basis.

II.2.2. Buildings and facilities.

The buildings and facilities must be built in a way to reserve enough working space for proper implementation of activities.
The height under ceiling must be two meters and a half at least.

The premises should be equipped in such a way that internal temperature may be compatible with proper conservation of target products, whatever the external temperature.

Workshops should be installed so as to meet the principle of "forward movement" of the product in order to avoid backward evolution and crossing between processed and non-processed products.

Various operations (washing, treatment if necessary, conditioning) should take place, whenever possible, in rooms that are physically separated with partitions.

Loading and unloading areas must be planned for and should be covered. The use of wharves for loading and unloading of palletized products is recommended.

II.3. Other general characteristics

II.3.1. Floors and walls

The floors and walls must be built with waterproof, non-absorbing, washable and non-toxic materials.

The walls should have smooth surfaces.

The floors must be non-slippery, free of cracks and easy to clean and disinfect.

The floor slope must be regulated so as to direct residue water toward a disposal whole equipped with a wire mesh and a siphon.

Waste water should be collected and evacuated in such a manner that in any case it may not constitute an contamination risk for products or moisture and peeling.

II.3.2. Ceilings

The surface of ceilings must be smooth and washable in order to avoid accumulation of dirt, to reduce dust condensation and to avoid moisture and peeling.

II.3.3. Ventilation and air renewal

An ad-hoc ventilation must be planned for to maintain fresh temperature for the product and replace polluted air. It should help avoid dust condensation and accumulation.

The air stream must be designed so that it goes from a clean area toward a less clean one (and therefore up-stream the product preparation chain).

II.3.4. Cloakrooms and toilettes

Sanitary installation including hand-washing tubs with cold and, if possible, hot water, toilettes (for lack of latrines which are isolated from the unit in order to prevent any contamination).

These premises should not communicate directly with working and storage areas. They must be permanently kept in clean conditions.

Hand-washing tubs must be provided with soap for hand cleaning and disinfecting. Hand-dryers, possibly for single usage, must be made available).

The hand-washing tubs must be located so that the staff stops there before returning in the working room. The use hand-washing tubs must be obligatory before moving to a risky area.

Written signs must be placed at visible locations to mention this obligation.

There must be sufficient numbers of cloakrooms.

II.3.5. Use of water

Supply of potable cold water under pressure and in sufficient quantity must be guaranteed for all operations in which the products are in direct contact with water and for which water is used to rinse and clean materials and utensils.

For export fruit and vegetable to European Union countries, potable water must meet hygiene standards defined by Guideline 98/83/CE of the Council dated November 3, 1998 about the quality of water intended for human consumption (JOCE No. L 330 dated 12/05/1998 p.32 to 54).

The use non-potable water, circulating in separate channels which are easily identifiable, may be used for all operations not related to food products.

If water should be treated at the level of the establishment (filtering, chemical treatment, etc.), the treatment must be submitted to a surveillance program.

Waste water should be evacuated in the environment while respecting national regulation.

II.3.6. Lighting

The premises where the products circulate must be sufficiently lighted.

To the extent possible, light sources must be located in such a way not to contaminate the products in case a tube or a light bulb breaks. They should be covered with a protection device.

Ultraviolet ray lamps for electrocution of flying insects must also be available. These lamps should be regularly cleaned and maintained.

II.3.7. Wastes

It is indispensable to plan for a systematic waste disposal system. This system must be maintained in good conditions.

Installations planned for waste and non-edible material storage must be designed so as to prevent access for devastators to and avoid contamination of food, potable water, materials and premises.

II.3.8. Miscellaneous

In areas where food is handled, all elements and accessories located above should be positioned in such a way to avoid direct contamination of food products and raw materials. Their lay-out and finishing touches must be designed so as to prevent filth accumulation.

Installations must be designed in a way to be protected from devastators, smoke and dust.

The presence of animals should be forbidden.

III. Hygiene rules for the maintenance of premises

Efficient measures must be taken in order to:

- ensure appropriate and efficient cleaning and disinfecting;
- ensure that there are no devastators (rodents, etc.);
- monitor waste flow in order to avoid cross contamination.

III.1. Cleaning

Cleaning activities must include the following:
- elimination of large surface scraps;
- application of a detergent solution or a disinfecting detergent in order to facilitate dirt washing off;
- rinsing with water to remove dirt and cleaning residue.

All materials and utensils used must be cleaned, disinfected and rinsed as often as needed and at least at the end of every work day.

III.2. Disinfecting

Once cleaning operations are over, disinfecting must be performed, if needed (depending on the nature of the product that was handled).

III.3. Convenient chemicals for cleaning and disinfecting of premises and materials

The products used must comply with national regulation in force and at the same time meet importing country requirements.

III.4. Organization

For each unit, it is necessary to define a cleaning and disinfecting program that helps ensure that all parts of the unit are cleaned and disinfected.

Controlling is performed visually in order to ensure efficient cleaning.

The cleaning programs must determine the following:
- the places;
- materials and products utilized;
- cleaning and disinfecting methods;
- frequencies;
- roles and responsibilities for all players;
- monitoring activities.

IV. Hygiene rules related to staff in contact with food products

Employers must establish and see to it that hygiene rules are appropriate and enforced to prevent food contamination.

They must ensure that any person in direct or indirect contact with food should:
- be medically capable of performing his/her work;
- is not suffering from an illness which may contaminate the products;
- knows the hygiene rules that are appropriate for the relevant food products.

IV.1. Medical surveillance

Medical surveillance is intended to prevent contamination risks for the products and staff.

The employer must comply with national regulation in force and particularly ensure that all employees in contact with food products have an up-dated medical capability certificate, delivered by the National Direction of Public Health.

It must be related to the relevant product and be paid for by the employer.

The employer must ensure that all staff members have medical insurance (public or private).

In case an employee falls sick (upon presentation of a medical certification of work interruption), the employer should, to the extent possible, continue total or partial payment of the employee's salary.

IV.2. Precautions and clothing

For each position, hygiene precautions must be learned and enforced by the staff.

Before any contact with the food product, staff must have received awareness-raising sessions about hygiene rules.

Clothing habits must be adapted for each position and clothes should be regularly cleaned.

The employer must provide employees with special uniforms for free.

Any person who evidently shows inadequate personal hygiene conditions should be denied access to

the workshops.

Hands must be washed immediately after using the toilettes (latrines), and before entering packaging facilities.

IV.3. Interdictions

Smoking, drinking alcohol, eating, spitting, chewing within the work premises must be forbidden. The employer must ensure that staff have access to a separate facility designed for such purposes.

IV.4. Visitors

All visitors must abide by the hygiene rules in force within the company.

V. Risk analysis for fresh fruit and vegetable treatment and conditioning

V.1. Production

Danger	Preventive Measures	Surveillance Procedures	Corrective Measures	Records
Chemical (pesticides, nitrates, heavy metals)	Setting-up a schedule of conditions Respecting doses and application periods. Not using urban wastes, cesspool wastes, etc.	Monitoring plan adapted to each product. Supplier audits. Laboratory analysis	Supplier assessment. Refusal of merchandises. Specific processing of the products (washing, trimming, etc.)	Suppliers' agricultural record books. Monitoring results. Non-conformity history and measures take.
Physical Foreign bodies animals, plants	Schedule of conditions, respecting treatment schedules	Visual control upon reception	Supplier assessment. Refusal of non-compliant merchandises.	Suppliers' agricultural record books. Monitoring results. Non-conformity history and measures taken.

V.2. Storage

Danger	Preventive Measures	Surveillance Procedures	Corrective Measures	Records
Chemical Contact with various products	Specific storage area. Maintenance of the refrigerator	Visual	Elimination of foreign products. Reshaping of the material	Material maintenance record
Physical	Preventive	Visual	Increasing	Archiving treatment

Proliferation of animals in the cold rooms	treatment against devastators		monitoring frequency	planning
Physiological Inadequate cooling	Changes in the cooling process	Temperature monitoring	Process rectification	Temperature statements

V.3. Washing – specific treatment

Danger	Preventive Measures	Surveillance Procedures	Corrective Measures	Recording
Physical Foreign bodies	Facility maintenance	Visual control of the final product	Material maintenance	Maintenance records
Chemical Water pollution due to undesirable products	Using potable water	Water analysis	Water treatment	Water analysis results
Pesticides, conserving matters	Schedule of conditions. Respecting regulatory requirements of destination countries	Respecting doses according to the process	Process rectification	Monitoring results

V.4. Sorting – packaging – weighing

Danger	Preventive Measures	Surveillance Procedures	Corrective Measures	Records
Physical Foreign bodies	Hygiene measures	Visual	Changes in hygiene rules Staff training	Defining written hygiene rules
Chemical	Food convenience of packages	Suppliers' schedule of conditions	Changing material/ suppliers	Constitutive elements/ nature of packages

V.5. Storage – expedition

Danger	Preventive Measures	Surveillance Procedures	Corrective Measures	Records
Physiological Inadequate cold chain	Cold equipment Schedule of conditions for transportation	Temperature monitoring	Maintenance of refrigerating material	Maintenance records

VI. Hygiene rules for transportation

The packaged product must be stored and transported in conditions which that preserve its integrity.

Transportation must be performed while maintaining appropriate temperature.

Annex II.
List of equipment to be acquired by CVL

1. Equipment

DESCRIPTION	TECHNICAL USE	QTY	TOTAL COST (FCFA)
For coupling to CPG. HP Mass spectrophotometer	Molecule detection and identification	1	49.500.000
Fluorimetric detector (190 – 800 mm) for CLHP HP	Detection of fungicides, mycotoxine, Polycyclic aromatic hydrocarbons	1	6. 900.000
800C° muffle furnace	Reactive heating and clean-up	1	1.800.000
Hydrogen generator	To provide hydrogen	1	1.400.000
Air generator	To provide oxygen	1	995.010
Freezers	Standard conservation	1	983.000
Refrigerators	Dilution conservation	1	758.000
25 KVA generator	To avoid energy shortages	1	9.000.000
UPS	To secure one hour energy autonomy	5	1.500.000
Installation costs	Installation of the mass spectrometer		5.000.000
Refrigerating 4000 tr./mn centrifuge	Separation of phases	1	2.800.000
TOTAL			80.636.010

2. Chromatography accessories

DESCRIPTION	TECHNICAL USE	QTY	TOTAL COST (FCFA)
CPG capillary columns	For analysis	5	1.700.000
CLHP columns	For analysis	6	1.000.000
Capillary column rinsing kit	Columns rinsing	2	800.000
Septum (10 piece-box)	Analysis	10	500.000
Ferule (10 piece-box)	Analysis	10	210.000
Water C8 extraction cartridge (100 pieces)	extraction	10	600.000
Statives, Pliers, elevators, balloon porters	Extraction and purification	10	1.000.000
Glass syringes and CLHP column adaptors for	Analysis and purgation	5	450.000
0,2 µm, 0,1µm, 1µm laboratory sieves (2/unit)	For sieving	6	350.000
TOTAL			6.610.000

3. Laboratory materials

DESCRIPTION	**TECHNICAL USE**	**QTY**	**TOTAL COSTS (FCFA)**
Ice boxes (80/50 liters)	Sample transportation and conservation	4	320.000
Movable ice boxes (12/220 volts) refrigerators and freezers (60 l)	Sample transportation and conservation	4	890.000
Trucks	Sediment sampling	1	780.000
Water sampling device	Water sampling	1	340.000
Medium capacity 1.600 C° (50 - 100 kg/j) incinerator	Incineration of laboratory generated toxic wastes	1	210.000.000
TOTAL			212.330.000

III. 4. Glassware

DESCRIPTION	TECHNICAL USE	QTY	TOTAL COSTS (FCFA)
Dessiccator	5000 ml	2	600.000
Pipettes (5/volume)	10 ml, 5ml, 2ml, 1ml, 0,5ml, 0,05 ml	30	75.000
Round bottom balloons (10/ volume)	500ml, 250ml, 150 ml, 50 ml	40	200.000
Conical bottom balloons (10/ volume)	50 ml 25 ml 5,ml	30	300.000
Mortars and pestles	Sample grinding	10	300.000
Empty-state separation funnels	For empty filtering	5	990.000
TOTAL			2. 465. 000

5. Reagents and Solvents

DESCRIPTION	TECHNICAL USE	QUANTITY	TOTAL COST (CFA)
Reagents and solvents	For analysis and extraction	as needed	10.000.000
Pesticide standards	For molecule identification	(see annex)	6.000.000
TOTAL			16.000.000

ANNEX III

List of Tropical fruit species submitted to phytosanitary control at importation into European Union member countries

Botanical name	Vernacular name	English name
Mangifera indica	Mangue	Mango
Annona cherimola	Chérimole	Cherimoya
Annona muricata	Corossol	Soursoup
Annona squamosa	Pomme cannelle	Sugar apple
Diospyros kaki	Kaki	Persimmon
Vaccinium	Canneberge	American cranberry
Psidium guava	Goyave	Guava
Sysygium javanica	Jambose	Java apple, water apple
Passiflora edulis	Fruit de la passion	Passion fruit
Passiflora ligularis	Grenadille douce	Sweet grenadilla
Passiflora mollissima	Tacso	banana passion fruit
Citrus grandis	Pamplemousse	Shaddock, pummelo
Citrus hystrix	Combava	Mauritius papeda
Citrus latifolia	Lime	Sour lime
Citrus limon	Citron	Lemon
Citrus medica	Cédrat	Citron
Citrus paradisi	Pomelo	Grapefruit
Citrus reticula	Mandarine	tangerin, mandarin
Citrus sinensis	Orange	sweet orange
Citrus reticula X	Ugli	
C. aurentifolia X	Limequat	Limequat
Fortunella margarita	Kumquat	Kumquat

Citrus fruit are submitted to particular requirements which are specified in Annex IVA1 of Guideline 77/93/CEE.

ANNEX IV.
List of materials available at the toxicology unit of the CVL

1. Available equipment

DESCRIPTION	QUTY	TECHNICAL USE
HP gas chromatograph equipped with ECD, NPD detector	1	Pesticide residue analysis
HP gas chromatograph equipped with FID, FPD detector	1	Pesticide residue analysis
High Performance liquid chromatograph (CLHP) equipped with UV detector	1	Herbicides and carbamates residue analysis
UV spectrophotometer	1	II.1.1 Physico-chemical parameters
Büchi Rotavapor	1	Evaporation
Chromatography columns	10	Purification
Settling funnels	10	Separation
Capillary columns	2	II.1.1 Pesticide analysis
CLHP columns	1	Herbicide, carbamats and HAP analysis
Refrigerator	1	Conservation of samples
Freezer	1	Conservation of samples
Mixer	1	Sample mixing
Grinder	1	Sample grinding
Mechanical vibrator	1	For absorption
Satorius precision scale	1	Weight measurement
Satorius electronic scale	1	Weight measurement
Ph-Meter	1	II.1.1 Ph measurement
Water pump	1	Water aspiration
Heating plate with bars	4	To heat substances
Empty-state pump	1	Aspiration
Cooker hood	1	Protection

2. Glassware

DESCRIPTION	VOLUME	QUANTITY
Gauging foils	1000 ml	6
	500 ml	6
	250 ml	6
	100 ml	6
	50 ml	12
	5 ml	6
Erlenmeyer	1000 ml	9
	500 ml	11
	250 ml	24
	125 ml	17
Cylinders	1000 ml	3
	500 ml	8
	250 ml	12
	100 ml	24
	50 ml	24
	25 ml	24
"Bêchers"	1000 ml	6
	400 ml	5
	250 ml	12
	150 ml	12
	100 ml	11
Settling bulbs	2000 ml	2
	1000 ml	5
	500 ml	12
	250 ml	12
	125 ml	12
Test tubes	1000 ml	6
	500 ml	12
	250 ml	12
Flat bottom balloons	1000 ml	5
	500 ml	10
	250 ml	12
	125 ml	4
Volumetric pipettes	10 ml	10
	5 ml	12
	4 ml	12
	2 ml	12
	3 ml	12
	1 ml	12
Chromatographic columns	medium size	8

Funnels	100 ml	6
	75 ml	12
	50 ml	12
Bûcher funnel	114 ml	8
Amber flasks	900 ml	12
	500 ml	12
Amber flasks	250 ml	24
	120 ml	24
	60 ml	24

3. Accessories and small laboratory materials

DESCRIPTION	TECHNICAL USE	QUANTITY
Bulb holders	Holding during separation	4
Gallows	Chromatographic column support	4
Swivel holders	Portable	8
Pliers (medium 3 prong extension)	Portable	8
Glove boxes	Protection	16
Sampling materials	For sampling	0
"Mali Gaze" gaze & bottle system	For analysis	3

V.4. Reagents and solvents

DESCRIPTION	QUANTITY
Acetone	16 l
Acetontryl	16 l
Ethylacetate	16 l
Dichloromethane	16 l
Diethylether	16 l
Hexane	16 l
Methanol	
Sodium anhydrous sulfate	50 kg
Florisil	250 g
Silica gels	250 g

PESTICIDE STANDARDS	**QUANTITY**
DDT	1 g
Dieldrine	50 mg
Lindane	1 g
2. 4 - D	1 g
chlorpyrifos	1 g
dimethoate	100 mg
fenitrothion	1 g
malathion	1 g
metamidophos	100 mg
Monocrotophos	1 g
Pirimiphos - methyl	1 g
profenofos	1 g
sulprofos	1 g
carbaryl	1 g
carbosulfan	100 mg
Baygon (TM)	1 g
cypermethrine	100 mg
deltametrhine	100 mg
tralomethrine	250 mg
atrazine	1 g
bladex	1 g
diflubenzuron	1 g
fluometuron	1 g
metolachlor	1 g
Paraquat CL tetrahydrate	1 g
Tetramethylthuiram disulfite	1 g
thiophanate	1 g
Thiophanate - methyl	1 g

ANNEX V.
Toxicology unit operating cost estimates

1. Additional equipment costs

DESCRIPTION	**TOTAL COSTS (CFA)**
Equipment	80. 636. 010
Glassware	2. 465. 000
Laboratory materials	212. 330. 000
Chromatography accessories	6. 610. 000
Solvents and reactives	16. 000. 000
Technical manuals and scientific newspapers	5. 000.000
TOTAL	**323.041.010**

2. Cost of additional equipment and indispensable reactives

DESCRIPTION	TOTAL COSTS - CFA
Equipment	80. 636. 010
Glassware	2. 465. 000
Laboratory materials	2. 330. 000
Chromatography materials	6. 610. 000
Solvents and reactives	16. 000. 000
Technical manuals and scientific newspapers	5. 000.000
Total	***110. 711. 010***

3. Equipment maintenance cost

The annual cost of material maintenance, including spare parts, is estimated at 15,000,000 F CFA (source: maintenance budget for the ecology laboratory in Korhogo).

4. Training cost for the technical assistant

TYPE OF TRAINING	DURATION
Laboratory Director - abroad	3 man/months
Laboratory Deputy Director – abroad	2 man/months
1 Assistant – abroad	2 man/months
Training of the laboratory team in Mali (3 persons)	3 man/months
Technical assistance	8 man/months

5. Service costs including mortgage and consumables

5. 1. Plant samples

MAIN INPUTS FOR THE ANALYSIS OF A VEGETAL SAMPLE	QUANTITY OF NECESSARY REACTIVES	COST IN FCFA
Methanol (rinsing)	300 ml	1. 275
Acetonitryl	150 ml	4. 500
Hexane	250 ml	8. 000
Dichloromethane	30 ml	800
Sodium anhydrous sulfate	10 g	62
Sodium chloride	10 ml	50
Celite	10 g	100
Florisil	20 g	300
Glass wool	10 g	155
Analytical phase	60 mn	101
Gaze vector	60ml/mn	120
Calibration standard	12 ìl	363
10 year depreciation for essential additional equipment	-	19.175
Labor (civil service senior staff) Duration of an analysis - 3 hours	479, 2 F CFA / h	1438
Motivation allowance	1438/2	719
TOTAL		37. 158

Analysis cost for a plant sample to research a pesticide family is estimated at (36,795 + 13,255) = 50,050 F CFA.

5. 2. Animal origin samples

MAIN INPUTS FOR THE ANALYSIS OF A SAMPLE OF ANIMAL ORIGIN	QUANTITY OF NECESSARY TEACTIVES	COST IN FCFA
Methanol (rinsing)	300 ml	1275
Hexane	250 ml	8. 000
Dichloromethane	80 ml	2. 133
Sodium anhydrous sulfate	100 g	620
Sodium chloride	10 ml	50
Florisil	20 g	300
Glass wool	10 g	155
Analytical phase	60 mn	101
Gaze vector	60ml/mn	120
Calibration standard	12 ìl	363
10 year depreciation for indispensable additional equipment	-	19.175
Labor (civil service senior staff) Duration of an analysis - 4 hours	479, 2 FCFA / h	1917
Motivation allowance	1917/2	959
TOTAL		35. 168

The cost for analyzing a sample from animal origin to research a pesticide family is estimated at (32,888 + 16,900) = 49,788 F CFA

5. 3. Soil and sediment samples

MAIN INPUTS FOR THE ANALYSIS OF A SOIL AND SEDIMENT SAMPLE	QUANTITY OF NECESSARY REACTIVES	COST IN FCFA
Methanol (rinsing)	300 ml	1275
Hexane	250 ml	8. 000
Dichloromethane	80 ml	2. 133
Sodium anhydrous sulfate	10 g	62
Sodium chloride	10 ml	50
Florisil	20 g	300
Glass wool	10 g	155
Analytical phase	60 mn	101
Gaze vector	60ml/mn	120
Calibration standard	12 ìl	363
10 year depreciation for indispensable additional equipment	-	19.175
Labor (civil service senior staff) Duration of an analysis : 4 hours	479, 2 F CFA / h	1917
Motivation allowance	1917/2	959
TOTAL		34. 610

The cost for analyzing a soil or sediment sample to research a pesticide family is estimated at (32,330 + 16,900) = 49,230 FCFA.

5. 4. Liquid or water samples

MAIN INPUTS FOR THE ANALYSIS OF A WATER OR LIQUID SAMPLE	QUANTITY OF NECESSARY REACTIVES	COST IN FCFA
Methanol (rinsing)	300 ml	1275
Hexane	250 ml	8. 000
Dichloromethane	80 ml	2. 133
Sodium anhydrous sulfate	10 g	62
Sodium chloride	10 ml	50
Florisil	20 g	300
Glass wool	10 g	155
Analytical phase	60 mn	101
Gaze vector	60ml/mn	120
Calibration standard	12 ìl	363
10 year depreciation for additional indispensable equipment	-	19.175
Labor (civil service senior staff) Duration of an analysis : 4 hours	479, 2 F CFA / h	1917
Motivation allowance	1917/2	959
TOTAL		34. 610

The cost for analyzing a liquid sample to research a pesticide family is estimated at (32,330 + 16,900) = 49,230 F CFA.

5. 5. Textile fiber or cloth

MAIN INPUTS FOR THE ANALYSIS OF A TEXTILE FIBER OR CLOTH	QUANTITY OF NECESSARY REAGENTS	COST IN FCFA
Methanol (rinsing)	300 ml	1275
Hexane	210 ml	6. 720
Acetone	250 ml	5. 000
Dichloromethane	80 ml	2. 133
Sodium anhydrous sulfate	10 g	62
Florisil	20 g	300
Glass wool	10 g	155
Analytical phase	60 mn	101
Gaze vector	60ml/mn	120
Calibration standard	12 ìl	363
10 year depreciation for indispensable additional equipment	-	19.175
Labor (civil service senior staff) Duration of an analysis : 4 hours	479, 2 F CFA / h	1917
Motivation allowance	1917/2	959
TOTAL		38. 280

The cost for analyzing a textile fiber or cloth sample to research a pesticide family is estimated at :

(36. 100 + 16. 900) = 53. 000 F CFA

5.6. Summary of costs per production type

TYPES OF PRODUCTION	RESEARCHING AN	RESEARCHING A
Plan origin	17. 983 F CFA	30. 875 F CFA
Animal origin	15. 993 F CFA	30. 613 F CFA
Soil and sediment	15. 435 F CFA	30. 055 F CFA
Liquid and water	15. 435 F CFA	30.055 F CFA
Textile fiber and clothes	19. 105 F CFA	33. 825 F CFA

[1]. Bringing targeted exporters together into an organization to be defined (GIE, cooperative or other) will undoubtedly be necessary to help them put together the amount of funds needed to invest for infrastructure.

[2]. See judicial system of quality control and certification for food products: public power and producers – WFO legal study No.54.

. Presently there is a standard for French beans (EEC Rule No.58/62). For mangoes, there are no community rules to-date. On the other hand, there are international rules (CEE/UN standard and Codex Alimentarius standard).

AOAC = Association Officielle des Chimistes Analystes.

Active substances whose utilization is banned in the European Union in accordance with Guideline 79/117/CEE dated December 21, 1978 (JOCEE L 033 dated 08.02.79 p.2) as revised last by Guideline 91/188/CEE.